

# Perceptions Related to Bird-to-Human Avian Influenza, Influenza Vaccination, and Use of Face Mask

J.T.F. Lau, J.H. Kim, H.Y. Tsui, S. Griffiths

## Abstract

**Background:** H5N1 avian influenza may become pandemic in humans in the near future. According to the severe acute respiratory syndrome (SARS) experience, anticipation of the pandemic may have impact on behaviors related to influenza vaccination (IV) and relevant public health behaviors such as wearing a face mask when having influenza-like-illnesses (ILI), which would play an important role in the control of human avian influenza outbreaks. This paper investigated the prevalence and factors related to IV uptake and use of face mask in public venues when having ILI symptoms.

**Methods:** An anonymous cross-sectional population-based random telephone survey of 302 Hong Kong Chinese adults aged 18–60, using a structured questionnaire, was conducted in November 2005.

**Results:** In the last 3 months, 17.9% of the respondents received IV; 36.6% of those presenting ILI symptoms often used face mask in public venues. Anticipation of a bird-to-human H5N1 outbreak, perceptions that such an outbreak would be worse than SARS, that IV was efficacious in preventing bird-to-human avian influenza transmission were associated with the studied IV behavior (OR=2.64–3.97,  $p < 0.05$ ). Exposure to live birds, perceived similar symptoms between influenza and bird-to-human H5N1 avian influenza, that bird-to-human avian influenza was more lethal than SARS were predictive use of face mask when having ILI symptoms (OR = 4.25–8.34,  $p < 0.05$ ).

**Conclusion:** The prevalence of IV and use of face mask in the study population may be increasing, which may be related to concerns of avian influenza. Perceptions related to human avian influenza were associated with IV and mask use behaviors. This can potentially be turned into opportunities of promoting desirable public health behaviors.

reported [4, 5]. Studies have recorded the prevalence of IV in the last year was reported to be 14.7% for those under 60 in a German study conducted in 2005 [6] and a study conducted in the United States in 2004 reported a similar prevalence of 17.9% for those aged 18–49 and 35.5% for those aged 50–64 [7]. According to a recent meta-analysis study [8], the relationships between risk perceptions and adult vaccination behaviors have been consistent; such relationships were stronger for studies that were prospective, had higher quality risk measures or had unskewed risk or behavior measures.

One factor that could affect prevalence of IV uptake is outbreaks of other emerging infectious diseases involving respiratory illnesses such as severe acute respiratory syndrome (SARS). After the SARS epidemic, governments of some countries have been promoting IV in some high-risk groups [9, 10]. The Hong Kong Government has been advising high risk groups (e.g., elderly aged 65 and above, persons with chronic illness, and poultry workers) to receive IV and has been providing free IV shots to older people living in nursing homes, chronic disease patients, pregnant women, young children of age 6–23 months, and health care workers [11]. However, except for the case of nursing home, elderly residents and health care workers, few organized efforts were made. The SARS experience may have influenced people to receive IV.

The prevalence of the general public using face masks increased from 11.5 to 85.4% from day 10–62 of the SARS epidemic in Hong Kong [12] which may have contributed to the control of the SARS epidemic [13]. Another study

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## Introduction

Influenza vaccination (IV) has been found effective for influenza prevention in different populations [1–3]. Some successful campaigns promoting IV have also been

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conducted in Hong Kong noted that at the end of the SARS epidemic in June 2003, 74.3% would use face mask if they were having influenza-like illnesses (ILI) symptoms, whereas the figure became 39.1% 3 months after the end of the SARS epidemic (September 2003) [14].

Recent outbreaks of H5N1 avian flu in birds and bird-to-human transmissions have greatly raised concerns about the possibility of an H5N1 avian influenza pandemic in humans in the near future [15–17]. Infectious disease experts are concerned about the likelihood of an antigenic shift of the H5N1 virus that could result in higher infectivity and pathogenicity via human-to-human transmissions [17, 18] that may cause a worldwide pandemic with an estimated 7.4 million deaths [19]. From January 2003 until 12 November 2007, 335 laboratory confirmed cases and 206 deaths of bird-to-human transmissions have been reported in 12 countries [20]. A small number of probable cases of human-to-human transmission had been reported in a few countries [21] but such cases are rare [22].

The global threat of avian influenza in humans should have impacts on health-related behaviors related to influenza, in terms of both protecting oneself (e.g., receiving IV) and others (e.g., using face mask when having ILI symptoms). Lowered incidence of ILI would reduce visits to clinics and hospitals during a human-to-human avian influenza outbreak and hence lower the chance of nosocomial infection and emotional distress; use of face mask may then also reduce chance of contracting ILI or the H5N1 virus. In the SARS epidemics, a number of studies suggested that the use of face masks in public venues has been effective in preventing contracting SARS [23]. The Hong Kong government has recently been promoting the use of face mask among those presenting ILI symptoms [24]. Some people may uptake IV as a means of preventing human avian influenza.

Three relevant papers investigating public perceptions on avian flu have been published in Hong Kong. The first paper found out that the majority of the respondents believed that there would be an avian flu outbreak in the year to come and anticipated psychological distress or interruption of daily routines in the event of a human avian flu outbreak [25]. The second paper concluded that in the event of a human flu outbreak, the public in Hong Kong is likely to adopt preventive measures [26]. The third paper indicated that there were widespread unconfirmed beliefs about the status of H5N1 epidemic [27].

This study investigated the prevalence of IV uptake among adults of age 18–60 and the prevalence of using face mask in public venues when having ILI symptoms (among those who have suffered from ILI in the past 3 months). Factors associated with IV and the use of face mask behaviors were also investigated, including exposure to live birds and perceptions related to bird-to-human H5N1 avian influenza. To our knowledge, these studies have not been reported.

## Materials and Methods

### Study Population and Sampling

The study population comprised Hong Kong Chinese adults aged 18–60. An anonymous cross-sectional telephone survey using a structured questionnaire was conducted in November 2005. The data used in this paper ( $n = 302$ ) formed a subset of a large dataset ( $n = 805$ ), which has been used in other published papers [25–27]. Variables of this subset of data have not been analyzed in the aforementioned published papers. Random telephone numbers were selected from up-to-date telephone directories. Telephone calls were made by trained interviewers from 6:30 p.m. to 10:00 p.m. to avoid over-representation of unemployed persons. For unanswered calls, at least three other independent calls were made before considering the number to be invalid. Similar methods have been used in a number of studies on SARS [11, 28] and an avian influenza study [29]. The household member whose last birthday was closest to the date of the interview was invited to join the study. Verbal informed consent was obtained from the respondents and ethics approval was obtained from the Research Ethics Committee of the Chinese University of Hong Kong. The response rate, defined as the number of completed interviews divided by the number of eligible households, was 57%.

### Measurements

Socio-demographic information was collected. Respondents were asked whether they had received IV in the last 3 months, whether they had suffered from ILI symptoms in the last 3 months and if so, whether they had often or always been wearing face masks in public venues when they were having ILI in the last 3 months.

Perception variables about various aspects of bird-to-human H5N1 transmission were assessed, such as perceived current availability of effective drugs and vaccines in Hong Kong, perceptions whether consequences of an anticipated local bird-to-human H5N1 outbreak would be worse than those of SARS (in terms of fatality, physical damage to patients, treatment efficacy, effectiveness of preventive measures, Hong Kong government's ability to control the anticipated bird-to-human H5N1 epidemic), perceived susceptibility of oneself or one's family member to contract bird-to-human H5N1 at times of a local outbreak, perceived chance of having a local bird-to-human H5N1 outbreak in Hong Kong in the next 12 months, whether being exposed to live birds/poultry in the last 3 months (defined as 'touching live birds', 'working in markets selling poultry', 'having bird pets', or 'bird-watching in parks' in the last 3 months), perceived efficacy of using IV and wearing face mask in public places to prevent bird-to-human avian influenza, perceived similarity between symptoms of bird-to-human avian influenza and influenza. Questions about the perceived modes of bird-to-human H5N1 transmission (respiratory droplets, body contacts, contaminated objects, and eating well-cooked poultry meat) were also asked. Response categories of these perception variables were binary (yes/no). These variables are mostly based on the Health Belief Model (HBM), which prescribes that variables such as perceived consequences, perceived susceptibility, and perceived efficacy are associated with practice of health-related behaviors [30]. The model has been used in number of IV studies [31, 32].

### Statistical Analyses

Age- and gender-specific prevalence of IV in the last 3 months were presented and odds ratios comparing age and

gender differences were derived. Perceptions related to bird-to-human H5N1 transmission were tabulated by gender, age groups, and education levels and  $\chi^2$  test was used to test for group differences. Univariate odds ratios for factors in association with IV in the last 3 months and use of face mask in public venues when suffering from ILI in the last 3 months were presented. Those univariately significant variables were used as candidates for multivariate stepwise logistic regression modeling. All computing was conducted using SPSS (SPSS Inc., Chicago, USA, 2005) and statistical significance was set at  $p < 0.05$ .

## Results

### Background Characteristics

Of the respondents, 53.3% were female, 35.4% of the respondents were of age 45–60, 32.6% had some college or university education, 29.5% were never married, 65.6% were employed full time. Of the male and female respondents, respectively, 19.9 and 10.6% had been exposed to live birds/poultry in the last 3 months (Table 1).

	Gender		All	
	Male (n = 141) Col (%)	Female (n = 161) Col (%)	$\chi^2$ test P	(n = 302) Col (%)
<i>Age group</i>				
18–34	36.9	36.0	0.98	36.4
35–44	27.7	28.6		28.1
45–60	35.5	35.4		35.4
<i>Education level</i>				
Matriculated or below	62.6	71.7	0.09	67.4
College/university or above	37.4	28.3		32.6
<i>Marital status</i>				
Ever married	65.2	75.2	0.06	70.5
Never married	34.8	24.8		29.5
<i>Employment status</i>				
Not employed full-time	19.9	47.2	<0.001	34.4
Employed full-time	80.1	52.8		65.6
<i>Exposure to live birds/poultry in the last 3 months<sup>a</sup></i>				
No	80.1	89.4	0.02	85.1
Yes	19.9	10.6		14.9
<i>Whether suffered from influenza like illness (ILI) in the last 3 months</i>				
No	71.6	67.1	0.39	69.2
Yes	28.4	32.9		30.8
<i>Frequency wearing face mask in public venue when suffering from ILI in the last 3 months<sup>b</sup></i>				
Never/seldom	57.5	67.9	0.30	63.4
Often/always	42.5	32.1		36.6

<sup>a</sup> Include 'touching live birds', 'working in markets selling poultry', 'having bird pets', and 'bird-watching in parks'

<sup>b</sup> Only among those who had suffered influenza like illness in the last 3 months (n = 93, with 40 males and 53 females)

### Prevalence of IV and Face Mask Use Behaviors when Having ILI Symptoms

Of all respondents, 30.8% self-reported having suffered from ILI in the last 3 months (28.4 and 32.9% for males and females, respectively, Table 1). Of these respondents who had suffered from ILI in the last 3 months, 36.6% self-reported that they had often or always been wearing face masks in public venues when having ILI symptoms in the last 3 months. No gender differences were observed (Table 1). From table 2, it can be seen that 17.9% of all respondents reported that they had received IV in the last 3 months. No statistically significant gender and age group differences were observed (Table 2).

### Perceptions Related to Bird-to-Human H5N1 Transmission

Of all respondents, 51.0 and 59.9%, respectively, believed that no effective drugs and vaccines were presently available to treat or to prevent bird-to-human avian influenza, while 68.5% believed that bird-to-human H5N1 symptoms are similar to those of influenza. Of all respondents, 80.8, 60.3, 58.3, and 25.8%, respectively, believed that bird-to-human H5N1 is transmittable via respiratory droplets, body contacts, contaminated objects, and eating well-cooked poultry meat. A total of 37.4% of all respondents believed that bird-to-human H5N1 have higher fatality rate, as compared to SARS, while 15.6, 11.6, and 10.6%, respectively, believed that an anticipated bird-to-human H5N1 outbreak in Hong Kong would be worse than those of the consequences of the SARS epidemic in terms of perceived physical damages to patients, efficacy of treatment, and effectiveness of preventive measures. However, the majority (63.9%) believed that the government would be doing better at times of a bird-to-human H5N1 outbreak as compared to the SARS epidemic (7.6% believed that the government would do worse) and 45.4 and 92.1%, respectively, of the respondents believed that IV and wearing face mask in public places could efficaciously prevent contracting bird-to-human H5N1. Except a few cases, gender, age groups, and education levels were not significantly associated with the above-mentioned perception variables (Table 3).

### Factors Associated with IV and Face Mask Use Behaviors in the Last 3 Months

The results of the multivariate analyses showed that those who perceived a high/very high chance of having a local bird-to-human H5N1 outbreak (OR = 3.20,  $p < 0.001$ ), those who indicated that such an outbreak would have worse consequences as compared to SARS in at least three out of the five studied items (OR = 3.97,  $p < 0.01$ ), and those who believed that uptake of IV would be efficacious in preventing one from contracting bird-to-human H5N1 (OR = 2.64,  $p < 0.01$ ) were more likely than others to have received IV in the last 3 months (Table 4). A few variables were univariately but not multivariately significant (Table 4).

Age groups	Male		Female		All		Male vs female
	Row (%) (95% CI)	OR (95% CI)	Row (%) (95% CI)	OR (95% CI)	Row (%) (95% CI)	OR (95% CI)	OR (95% CI)
18–34	19.2 (8.5, 29.9)	1.00	12.1 (3.7, 20.5)	1.00	15.5 (8.7, 22.2)	1.00	1.74 (0.61, 4.95)
35–44	25.6 (11.9, 39.4)	1.45 (0.54, 3.92)	15.2 (4.8, 25.6)	1.31 (0.42, 4.04)	20.0 (11.5, 28.5)	1.37 (0.65, 2.87)	1.92 (0.65, 5.65)
45–60	16.0 (5.8, 26.2)	0.80 (0.29, 2.23)	21.1 (10.5, 31.6)	1.94 (0.70, 5.36)	18.7 (11.3, 26.1)	1.26 (0.62, 2.56)	0.71 (0.27, 1.92)
All	19.9 (13.3, 26.4)	–	16.1 (10.5, 21.8)	–	17.9 (13.6, 22.2)	–	1.29 (0.71, 2.32)

OR: univariate odds ratio

	Gender		P <sup>a</sup>	Age group		P <sup>a</sup>	Education level		P <sup>a</sup>	All
	Male	Female		18–44	45–60		≤Matriculated	≥College/ university		
	Col (%)	Col (%)	Col (%)	Col (%)	Col (%)	Col (%)	Col (%)			
<i>Medical aspects of bird-to-human H5N1 (% agreeing)<sup>b</sup></i>										
No effective drugs currently available	54.6	47.8	0.24	52.8	47.7	0.39	46.8	58.8	0.05	51.0
No effective vaccine currently available	64.5	55.9	0.13	60.0	59.8	0.98	58.2	61.9	0.55	59.9
With symptoms similar to those of influenza	70.2	67.1	0.56	66.7	72.0	0.34	66.7	75.3	0.13	68.5
<i>Perceived modes of transmission of bird-to-human H5N1 (% yes)<sup>c</sup></i>										
Respiratory droplets	80.9	80.7	0.98	81.0	80.4	0.89	80.1	81.4	0.78	80.8
Body contacts	63.1	57.8	0.34	59.5	61.7	0.71	63.2	54.6	0.16	60.3
Objects contaminated with the virus	61.0	55.9	0.37	53.8	66.4	0.04	55.7	61.9	0.32	58.3
Eating well-cooked poultry meat	23.4	28.0	0.37	26.7	24.3	0.65	26.9	23.7	0.56	25.8
<i>Number of items with 'yes' responses to the above four modes</i>										
0–2	54.6	55.3	0.91	57.4	50.5	0.24	54.2	57.7	0.57	55.0
3–4	45.4	44.7		42.6	49.5		45.8	42.3		45.0
<i>Perceived susceptibility to bird-to-human H5N1 infection and chance of a local outbreak (% high/very high)</i>										
Perceived susceptibility of oneself in contracting the virus	16.3	11.2	0.19	15.9	9.3	0.11	13.4	13.4	0.99	13.6
Perceived susceptibility of one's family members in contracting the virus	17.0	11.2	0.14	16.4	9.3	0.09	14.4	12.4	0.63	13.9
Perceived chance of a large outbreak in Hong Kong	31.2	28.6	0.62	32.8	24.3	0.12	29.9	29.9	0.99	29.8
<i>% Perceiving impacts of bird-to-human H5N1 worse than those of SARS<sup>e</sup></i>										
Fatality rate	42.6	32.9	0.08	36.9	38.3	0.81	38.3	35.1	0.59	37.4
Permanent physical damages to the patients	14.9	16.1	0.76	15.4	15.9	0.91	16.4	13.4	0.50	15.6
Efficacy of treatment	10.6	12.4	0.63	12.8	9.3	0.37	11.4	12.4	0.82	11.6
Effectiveness of preventive measures	14.9	6.8	0.02	11.3	9.3	0.60	7.5	15.5	0.03	10.6
Government's ability to control the outbreak	10.6	5.0	0.06	7.7	7.5	0.95	7.5	8.2	0.81	7.6
<i>Number of items with 'worse than SARS' responses to the above five items</i>										
0–2	88.7	90.7	0.56	89.7	89.7	1.00	90.0	88.7	0.71	89.7
3–5	11.3	9.3		10.3	10.3		10.0	11.3		10.3
<i>% Perceiving high/very high efficacy for prevention of bird-to-human H5N1 infection<sup>d</sup></i>										
Influenza vaccine	43.3	47.2	0.49	43.6	48.6	0.40	48.3	39.2	0.14	45.4
Wearing face mask in the public place	92.9	91.3	0.61	89.7	96.3	0.04	92.0	91.8	0.93	92.1

<sup>a</sup>  $\chi^2$  test; <sup>b</sup> Answer options include 'agree', 'disagree', and 'not certain'; <sup>c</sup> Answer options include 'yes', 'no', and 'not certain'; <sup>d</sup> Answer options include 'very high', 'high', 'low', 'very low', and 'not certain'; <sup>e</sup> Answer options include 'worse than SARS', 'same as SARS', 'better than SARS', and 'not certain'

Table 4 Factors associated with uptaking influenza vaccine in the last 3 months.			
	Vaccinated against influenza (last 3 months)		
	Row (%)	OR (95% CI)	OR <sub>m</sub> (95% CI)
<i>Background characteristics</i>			
Gender			
Male	19.9	1.00	-
Female	16.1	0.78 (0.43, 1.40)	-
Age group			
18-44	17.4	1.00	-
45-60	18.7	1.09 (0.59, 2.01)	-
Education level			
≤Matriculation	17.9	1.00	-
≥College/university	18.6	1.04 (0.56, 1.95)	-
Marital status			
Ever married	19.7	1.00	-
Never married	13.5	0.64 (0.32, 1.27)	-
Employment status			
Not employed full-time	15.4	1.00	-
Employed full-time	19.2	1.31 (0.69, 2.48)	-
Exposed to live birds/poultry in the last 3 months <sup>a</sup>			
No	17.5	1.00	-
Yes	20.0	1.18 (0.53, 2.62)	-
<i>Medical aspects of bird-to-human H5N1</i>			
No effective drugs currently available			
Disagree/not certain	18.9	1.00	-
Agree	16.9	0.87 (0.48, 1.57)	-
No effective vaccine currently available			
Disagree/not certain	15.7	1.00	-
Agree	19.3	1.29 (0.70, 2.38)	-
With symptoms similar to those of influenza			
Disagree/not certain	12.6	1.00	-
Agree	20.3	1.76 (0.88, 3.52)	-
<i>Perceived modes of transmission of bird-to-human H5N1</i>			
Respiratory droplets			
No/not certain	19.0	1.00	-
Yes	17.6	0.91 (0.44, 1.91)	-
Body contacts			
No/not certain	11.7	1.00	NS
Yes	22.0	2.13* (1.10, 4.12)	-
Objects contaminated with the virus			
No/not certain	16.7	1.00	-
Yes	18.8	1.15 (0.63, 2.11)	-
Eating well-cooked poultry meat			
No/not certain	16.1	1.00	-
Yes	23.1	1.57 (0.83, 2.96)	-
No. of items with "yes" responses to the above four modes			
0-2	16.3	1.00	-
3-4	19.9	1.28 (0.71, 2.30)	-
<i>Perceived susceptibility to bird-to-human H5N1 infection &amp; chance of a local outbreak</i>			
Perceived susceptibility of oneself in contracting the virus			
Low/very low/not certain	16.9	1.00	-
High/very high	24.4	1.59 (0.73, 3.48)	-
Perceived susceptibility of one's family members in contracting the virus			
Low/very low/not certain	17.7	1.00	-
High/very high	19.0	1.10 (0.48, 2.52)	-
Perceived chance of a large outbreak in Hong Kong			
Low/very low/not certain	12.3	1.00	1.00
High/very high	31.1	3.23*** (1.76, 5.92)	3.20*** (1.68, 6.09)

(continued next page)

Table 4 continued.	Vaccinated against influenza (last 3 months)		
	Row (%)	OR (95% CI)	OR <sub>m</sub> (95% CI)
<i>Perceived impacts of bird-to-human H5N1 worse than those of SARS</i>			
Fatality rate			
Same as SARS/better than SARS/not certain	13.8	1.00	NS
Worse than SARS	24.8	2.07* (1.14, 3.74)	
Permanent physical damages to the patients			
Same as SARS/better than SARS/not certain	14.5	1.00	NS
Worse than SARS	36.2	3.34** (1.68, 6.65)	
Efficacy of treatment			
Same as SARS/better than SARS/not certain	16.9	1.00	-
Worse than SARS	25.7	1.71 (0.75, 3.89)	
Effectiveness of preventive measures			
Same as SARS/better than SARS/not certain	17.4	1.00	-
Worse than SARS	21.9	1.33 (0.54, 3.25)	
Government's ability to control the outbreak			
Same as SARS/better than SARS/not certain	15.8	1.00	NS
Worse than SARS	43.5	4.11** (1.70, 9.96)	
No. of items with 'worse than SARS' responses to above five items			
0-2	14.8	1.00	1.00
3-5	45.2	4.76*** (2.17, 10.41)	3.97** (1.71, 9.18)
Perceived efficacy of influenza vaccine for prevention of bird-to-human H5N1 transmission			
Low/very low/not certain	12.1	1.00	1.00
High/very high	24.8	2.39** (1.30, 4.39)	2.64** (1.38, 5.03)

OR: univariate odds ratio; OR<sub>m</sub>: odds ratio obtained from stepwise multivariate logistics regression analysis using univariately significant variables as candidate variables; NS: not significant; -: univariately non-significant; <sup>a</sup> Include 'touching live birds', 'working in markets selling poultry', 'having bird pets', and 'bird-watching in parks'; ~0.05 < p < 0.01; \*p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001

Out of all studied variables, three were both univariately and multivariately significant in predicting the use of face mask in public venues when presenting ILI symptoms in the last 3 months; exposure to live birds/poultry (OR = 8.34,  $p < 0.05$ ), perception that bird-to-human H5N1 would have symptoms that are very similar to those of influenza (OR = 6.33,  $p < 0.01$ ), and those perceiving bird-to human H5N1 would be associated with a higher fatality rate as compared to SARS (OR = 4.25,  $p < 0.01$ , Table 5).

### Discussion

The present study found that, in a 3-month period before the survey, 17.9% of the respondents received IV and 36.6% of those presenting ILI symptoms often used face mask in public venues. Factors associated with IV uptake behavior include anticipation of a bird-to-human H5N1 outbreak, perceptions that such an outbreak would be worse than SARS, and that IV was efficacious in preventing bird-to-human avian influenza transmission, whereas factors associated with the use of face mask when having ILI symptoms include exposure to live birds, perceived similar symptoms between influenza and bird-to-human H5N1 avian influenza, and that bird-to-human avian influenza was more lethal than SARS.

A study conducted in January 2004 (about 6 months after the ending of the SARS epidemic) found that 11% of the 1,106 respondents aged 18-59 had received IV in the

preceding 3 months (unpublished data). It should be noted that the 2004 study was conducted around the peak influenza season (January-April) whereas this study was conducted in November 2005. It was also found that 74.3 and 39.1%, respectively, reported that they would use face masks when having ILI symptoms in June and September 2003 [14].

As discussed, the Hong Kong government advised high-risk groups to be vaccinated against influenza [33]. It has also been promoting the use of mask when having ILI symptoms, both during the SARS epidemic [34] and as a component of community preparedness for the anticipated human avian influenza outbreak [24]. Announcements of public interest were broadcasted regularly on television (available at [http://www.chp.gov.hk/content.asp?lang=en&info\\_id=10094](http://www.chp.gov.hk/content.asp?lang=en&info_id=10094)) and very frequently (almost hourly) in train stations to promote mask use when having ILI symptoms. The governmental position on mask use when having ILI symptoms is therefore clear and consistent. Governmental positions on public health measures may have affected public health behaviors. International comparisons are warranted.

High prevalence of both the above-mentioned IV and the use of face mask behaviors was observed when outbreaks of emerging infectious diseases are evident (e.g., SARS) or being anticipated (e.g., human H5N1). These behaviors may be seen by means of self-protection and/or protecting others. A continual rise of the prevalence of

Table 5 Factors associated with wearing face mask when going out (among those suffering ILI in the last 3 months).			
	Wore face mask when suffering ILI (last 3 months)		
	Row (%)	OR (95% CI)	OR <sub>m</sub> (95% CI)
<i>Background characteristics</i>			
Gender			
Male	42.5	1.00	-
Female	32.1	0.64 (0.27, 1.50)	-
Age group			
18-44	33.3	1.00	-
45-60	44.4	1.60 (0.64, 4.00)	-
Education level			
≤Matriculation	41.7	1.00	-
≥College/university	31.1	0.63 (0.27, 1.48)	-
Marital status			
Ever married	34.8	1.00	-
Never married	40.7	1.29 (0.51, 3.22)	-
Employment status			
Not employed full-time	30.4	1.00	-
Employed full-time	38.6	1.44 (0.52, 3.94)	-
Exposed to live birds/poultry in the last 3 months <sup>a</sup>			
No	32.5	1.00	1.00
Yes	70.0	4.84* (1.16, 20.19)	8.34* (1.49, 46.76)
<i>Medical aspects of bird-to-human H5N1</i>			
No effective drugs currently available			
Disagree/not certain	34.8	1.00	-
Agree	38.3	1.16 (0.50, 2.71)	-
No effective vaccine currently available			
Disagree/not certain	34.2	1.00	-
Agree	38.2	1.19 (0.50, 2.82)	-
With symptoms similar to those of influenza			
Disagree/not certain	14.8	1.00	1.00
Agree	45.5	4.79** (1.49, 15.39)	6.33** (1.76, 22.71)
<i>Perceived modes of transmission of bird-to-human H5N1</i>			
Respiratory droplets			
No/not certain	42.9	1.00	-
Yes	34.7	0.71 (0.26, 1.91)	-
Body contacts			
No/not certain	36.8	1.00	-
Yes	36.4	0.98 (0.42, 2.31)	-
Objects contaminated with the virus			
No/not certain	35.7	1.00	-
Yes	37.3	1.07 (0.46, 2.50)	-
Eating well-cooked poultry meat			
No/not certain	38.0	1.00	-
Yes	31.8	0.76 (0.28, 2.10)	-
No. of items with "yes" responses to the above four modes			
0-2	34.6	1.00	-
3-4	39.0	1.21 (0.52, 2.82)	-
<i>Perceived susceptibility to bird-to-human H5N1 infection &amp; chance of a local outbreak</i>			
Perceived susceptibility of oneself in contracting the virus			
Low/very low/not certain	35.4	1.00	-
High/very high	45.5	1.52 (0.43, 5.42)	-
Perceived susceptibility of one's family members in contracting the virus			
Low/very low/not certain	35.4	1.00	-
High/very high	45.5	1.52 (0.43, 5.42)	-
Perceived chance of a large outbreak in Hong Kong			
Low/very low/not certain	33.3	1.00	-
High/very high	44.4	1.60 (0.64, 4.00)	-

(continued next page)

Table 5 continued.			
	Wore face mask when suffering ILI (last 3 months)		
	Row (%)	OR (95% CI)	OR <sub>m</sub> (95% CI)
<i>Perceived impacts of bird-to-human H5N1 worse than those of SARS</i>			
Fatality rate			
Same as SARS/better than SARS/not certain	27.4	1.00	1.00
Worse than SARS	54.8	3.21* (1.31, 7.91)	4.25** (1.52, 11.86)
Permanent physical damages to the patients			
Same as SARS/better than SARS/not certain	32.9	1.00	-
Worse than SARS	57.1	2.72 (0.85, 8.65)	-
Efficacy of treatment			
Same as SARS/better than SARS/not certain	34.9	1.00	-
Worse than SARS	50.0	1.86 (0.50, 6.97)	-
Effectiveness of preventive measures			
Same as SARS/better than SARS/not certain	36.0	1.00	-
Worse than SARS	42.9	1.33 (0.28, 6.33)	-
Government's ability to control the outbreak			
Same as SARS/better than SARS/not certain	36.0	1.00	-
Worse than SARS	42.9	1.33 (0.28, 6.33)	-
No. of items with 'worse than SARS' responses to above five items			
0-2	36.8	1.00	-
3-5	33.3	0.86 (0.15, 4.96)	-
Perceived efficacy of wearing face mask in public place for prevention of bird-to-human H5N1 transmission			
Low/very low/not certain	20.0	1.00	-
High/very high	38.6	2.51 (0.50, 12.57)	-

OR: univariate odds ratio; OR<sub>m</sub>: odds ratio obtained from stepwise multivariate logistics regression analysis using univariately significant variables as candidate variables; NS: not significant; -: univariately non-significant; <sup>a</sup> Include 'touching live birds', 'working in markets selling poultry', 'having bird pets', and 'bird-watching in parks'; ~0.05 < p < 0.01; \*p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001

such behaviors is expected in the near future as the threat from human avian influenza is of a growing concern. It is reported that the majority of the Hong Kong respondents anticipated practicing some forms of preventive measures at times when only 2–3 human-to-human H5N1 cases were reported [26].

We have clearly established in this study population that perceived chance of local bird-to-human H5N1 outbreak in the next 12 months, perceptions that impacts of bird-to-human H5N1 would be worse than those of SARS, and perceived efficacy of using IV to prevent contracting bird-to-human H5N1 were strongly predictive of having been vaccinated against influenza in the last 3 months. These factors are in line with those key variables prescribed by the Health Belief Model (perceived susceptibility, consequences and efficacy), at least partially supporting the use of HBM to study IV behaviors [35, 36].

Factors associated with face mask use in public venues when having ILI is equally consistent in suggesting public health behaviors that have been influenced by anticipation of emerging infectious diseases. Another study documented that prevalent public health behaviors (hand-washing, use of face mask when having ILI) were also associated with the respondents' SARS experience [14].

A very high percentage (45.4%) of all respondents believed that IV is efficacious in preventing bird-to-human

H5N1. To our knowledge, such a relationship has not been documented. Other unconfirmed beliefs exist. For instance, 48% of the Hong Kong respondents believed that avian influenza could be transmitted via insect bites [27]. It is interesting to know that some unconfirmed beliefs (or even misconceptions) related to some emerging infectious diseases, were in fact, associated with desirable preventive behaviors. This may be due to the underlying fear of contracting the disease, a potential confounder, which is both associated with the unconfirmed beliefs and preventive behaviors in question. A recent web-based study in Norway has shown how fear and anxiety would distort decision making in the context of imminent influenza pandemic [37]. A paper reported that high percentages of Hong Kong people anticipated panic and interruption of daily routines in the event of a human influenza outbreak [25]. It would be an interesting topic of debate among health policy makers and workers in how to rectify misconceptions, without upsetting the associated desirable public health prevention behaviors. It is speculated that incidence of IV would decrease if the government firmly explained that there is no good evidence to support the claim that IV would prevent avian flu. The government should, however, explain the benefits of IV for preventing influenza, which would be problematic if there was a sudden avian flu outbreak. The public health behavior could still be promoted with a more scientific reason.



The study further demonstrated that preventive behaviors of different types of infectious respiratory diseases are inter-related. The government can turn the threat of emerging infectious disease into opportunities for promoting relevant public health behaviors. The explanation of the advantages of IV and ILI preventive means (e.g., mask use, hand-washing) as a way to prepare for the outbreak of avian flu, therefore, has a promising chance of success. That is what currently the Hong Kong Government is doing and such promotion campaigns have long-term public health implications. As avian influenza has become a global concern, it is possible that the implications derived from the study can be generalized to other countries. A recent web-based study in Norway showed that though only a minority of the public perceived a risk greater than that of their health authorities estimates, most are ready to adopt some precautions [38]. Promotion of ILI-related prevention means should be considered as part of the avian flu preparedness.

The study has some limitations. First, the study was conducted using telephone surveys and some households may not have been included. In Hong Kong, however, almost all households have telephones [39] and a large number of local published studies on SARS [12, 14, 40], influenza vaccination, [41], and avian influenza [29] have utilized this method. Second, the response rate of the study has not been very high. Again, the response rate has been similar to many of the other local studies that have been published [13, 29, 42] with the distributions of 18–39 and 40–60 groups being quite comparable to those obtained from the Census data (49.6 and 50.4%, respectively). The gender distributions (46.6 and 53.4% male and female, respectively) were also comparable to the 2005 Census distributions of 47.8% male and 52.0% female [43]. The crude comparison with Census data give some support to the generalization of the results of the study. Responses such as IV and the use of face mask were self-reported and had not been validated. However, the study was anonymous and during this pre-outbreak stage, it is unlikely that social desirability strongly biased the reporting of these behaviors. Associations rather than causal effects were obtained in this cross-sectional study. In fact, many studies investigating factors predicting IV were of cross-sectional nature [6, 36, 41, 44]. Cohort studies are very difficult to set up as an individual's perceptions on avian flu can change. Recall bias is also unlikely to be significant due to the relatively short recall period of 1–3 months. The sample size is relatively small due to resource constraints. The obtained 95% confidence interval for the prevalence of IV and mask use were about 5–6% in width and the corresponding odds ratios are highly significant, which suggests that the sample size is adequate to address the research questions.

In sum, the study shows that both IV and the use of face mask in public venues when suffering from ILI were strongly associated with perceptions related to anticipated

bird-to-human avian influenza outbreak in Hong Kong. Immediate behavioral changes related to avian influenza has been document [27]. It is speculated that when an avian flu outbreak occurs, changes in relevant perceptions would increase the prevalence of the studied public health behaviors rapidly. It may still be debatable whether such preventive measures would be effective in prevention of human avian influenza. However, there is preliminary evidence given by the SARS experience suggesting such means are potentially useful. Such studies of public health behaviors may be crucial in the control of anticipated human avian influenza outbreaks. The public is vigilant and responsive to the threat of emerging infectious diseases; such was evident in the case of SARS. Anticipation of emerging infectious diseases hence also offers opportunities for the promotion of IV and other public health behaviors related to influenza prevention.

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